A FIELD STUDY OF TEMPERATURE REGULATION IN YOUNG LEAST TERNS AND COMMON NIGHTHAWKS

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The study of temperature regulation in young birds dates back at least to the time of Edwards (1824), who divided nestlings into two groups—those able to maintain a more or less constant body temperature soon after hatching (precocial), and those that are unable to do this, so that their body temperature varies with that of the environment (altricial). The terms in parentheses above are usually used to designate the two groups, but nidifugous (young able to leave the nest site shortly after hatching) and nidicolous (young restricted to the nest and dependent on parental care) are often employed as equivalents of precocial and altricial, respectively. Birds that nest on the bare ground are frequently assumed to be precocial, but there are very few published studies on such species that include measurements of body temperatures of the young. The present study was undertaken in the hope of adding to the limited data available on this subject.

Most of the information presented here was obtained in July, 1955, at Grand Isle, Jefferson Parish, Louisiana. This locality is on the coast of the Gulf of Mexico about 100 miles south of New Orleans. Some additional data were obtained at Los Angeles, California, in August, 1956.

The two species studied were the Least Tern (*Sterna albifrons*) and the Common Nighthawk (*Chordeiles minor*). At Grand Isle both these species lay their eggs on sand or bare ground, and the young may be exposed alternately to intense solar heat and to cooler periods brought on by frequent thunderstorms. The terns are strictly diurnal, and although the nighthawks may be active at any time of the day they are primarily crepuscular and nocturnal in this region during the hottest part of the summer. These two species, although different in most respects, are similar in the type of nest site utilized; it therefore seemed that a comparison of the adaptations of their young to similar environmental conditions would be of interest.

All body temperatures listed are esophageal, in degrees C., and were taken with a quick-registering mercury thermometer unless otherwise noted. I am aware of the shortcomings of mercury thermometers as compared to thermocouples, but the field investigator usually has no choice but to use the former. Therefore, body temperatures recorded may not be as precise as possible but they are consistent and adequate for comparisons between the two species. Environmental temperatures were also taken with the same quick-registering mercury thermometers unless otherwise noted and are in degrees C. It was often desirable to have black-bulb temperatures as a measure of the intensity of solar radiation. "Black-bulbs" were improvised from the black cardboard tubing of the thermometer case or from a small glass test tube thoroughly blackened with camphor smoke. When held around the mercury bulb of the thermometer, both these "black-bulbs" gave almost identical results. Obviously the readings are not as accurate as those obtained with meteorological equipment, but like the body temperatures they are consistent throughout this study and thus have some comparative value.

Least Tern

On July 1, 1955, I located 15 nests with eggs of this species at Grand Isle in a large level expanse of white sand mixed with shell fragments. As July is late in the breeding season of the Least Tern in this region, these sets of eggs were almost certainly not the first clutches. The nesting area was roughly rectangular and was surrounded on three sides by marsh and bordered by a bayou on the fourth. There was virtually no vegetation and no shade anywhere in the nesting area. No other species were nesting there, but flocks of Black Terns (*Chlidonias niger*) and Laughing Gulls (*Larus atricilla*) were frequent visitors.

Unfortunately, there was little nesting success in this colony. Eight nests were destroyed by children who followed my footprints across the sand, and several others were raided by raccoons from the surrounding marsh. Laughing Gulls apparently preyed on both eggs and young. However, I was able to get some data on a few very young nestlings from three of the nests. I attempted to take temperatures of the nestlings as soon as possible after the brooding parent departed, and I then remained by the nest and took temperatures of the young at regular intervals during their continued exposure to the environment. It was not always possible to tell how soon after departure of the parent the first temperature was recorded, for most of the adult birds in the colony took wing as I approached the edge of the area. In such instances I could record only that the time unbrooded was something greater than the number of minutes that elapsed between sighting an unbrooded nest and taking the temperature.

The results obtained from five nestlings on five different occasions are summarized in Table 1. It will be noted that body temperatures in one- and two-day-old nestlings varied through about 8°C., but did not rise above 42.5°C. in these or in a three-day-old nestling, even though black-bulb and ground temperatures rose above this figure. Presumably the nestlings regulated their body temperature more effectively at the high than at the low end of the scale, and I was able to get additional information on this point in August, 1956, by subjecting nestling Least Terns to heat and cold stress under laboratory conditions.

Two nestling terns were found in a breeding colony at Playa del Rey, Los

Table 1
Environmental Temperatures and Body Temperatures (in °C.) of Five Least Tern Nestlings One to Three Days Old
(Each column represents separate, nonconsecutive records)

Time since parent left	> 5 min.	> 5 min.	> 3 min.	> 5 min.	>5 min.[1]
Ground	31.0	42.5	29.5	30.2	49.5
Black-bulb	28.4	44.0	night	28.5	43.0
Air			29.5	28.5	
1 day old	36.2	42.5	37.2	34.2	
2 days old		42.5	38.2	35.0	42.2
3 days old					42.5

[1] Extremely conservative estimate of time.

Angeles, on August 1. One appeared slightly smaller and younger than the other; the smaller one was more white and the larger one more yellow in color. The letters (W) and (Y) are used to distinguish these two young birds in the following discussion. I estimated that (W) was no more than one day old and that (Y) was two days of age at most. Deep esophageal temperatures taken immediately after the brooding parent left were 40.5 (W) and 41.5°C. (Y); during the following hour, these body temperatures (unbrooded) varied only between 40.0 and 41.2°C. (W) and 40.8 and 42.5°C. (Y) at an air temperature (with 5 m.p.h. wind) of 27 to 29°C., a black-bulb temperature of 35.5°C., and a ground temperature of 33 to 36.5°C. A few hours later I returned to the nesting colony and took the two nestlings to the laboratory. They each weighed 5.7 grams, and after about 30 minutes at ambient temperatures of 24 to 30°C., their body temperatures (taken at 4 p.m.) were 33.5 (W) and 35.2°C. (Y). These and other temperatures recorded in the laboratory were measured by a thermocouple. At 4:30 p.m. both birds were placed in a cold chamber at an ambient temperature of 10°C.; this declined gradually to 5.5°C. The laboratory results are shown in Figure 1.

At 4:26 p.m., when the birds were at their lowest body temperature, both were capable of slow movement and (Y) cheeped faintly. The young birds were returned to their nest at 5:03 p.m., and a parent bird settled down to brood them almost immediately.

The next day I returned to this nest and found (W) but not (Y). The body temperature of (W) was 41.6°C. within two minutes after the departure of the brooding parent. When taken to the laboratory again, (W) weighed 6.1 grams, an increase of 0.4 gram over the previous day. At the laboratory room temperature of 23.0°C., the body temperature of (W) dropped to 36.4°C. in about 20 minutes. At this time, 3:57 p.m., (W) was placed in an insulated chamber at an air temperature varying between 43 and 45°C.; results are shown in Figure 2.

It will be noted that during the first six minutes there was a rise of 4.1°C. in body temperature. During the following 16 minutes the bird maintained a fairly constant body temperature, but after that a rise to higher levels commenced. However, the body temperature remained below that of the surrounding air for the entire 38-minute period.

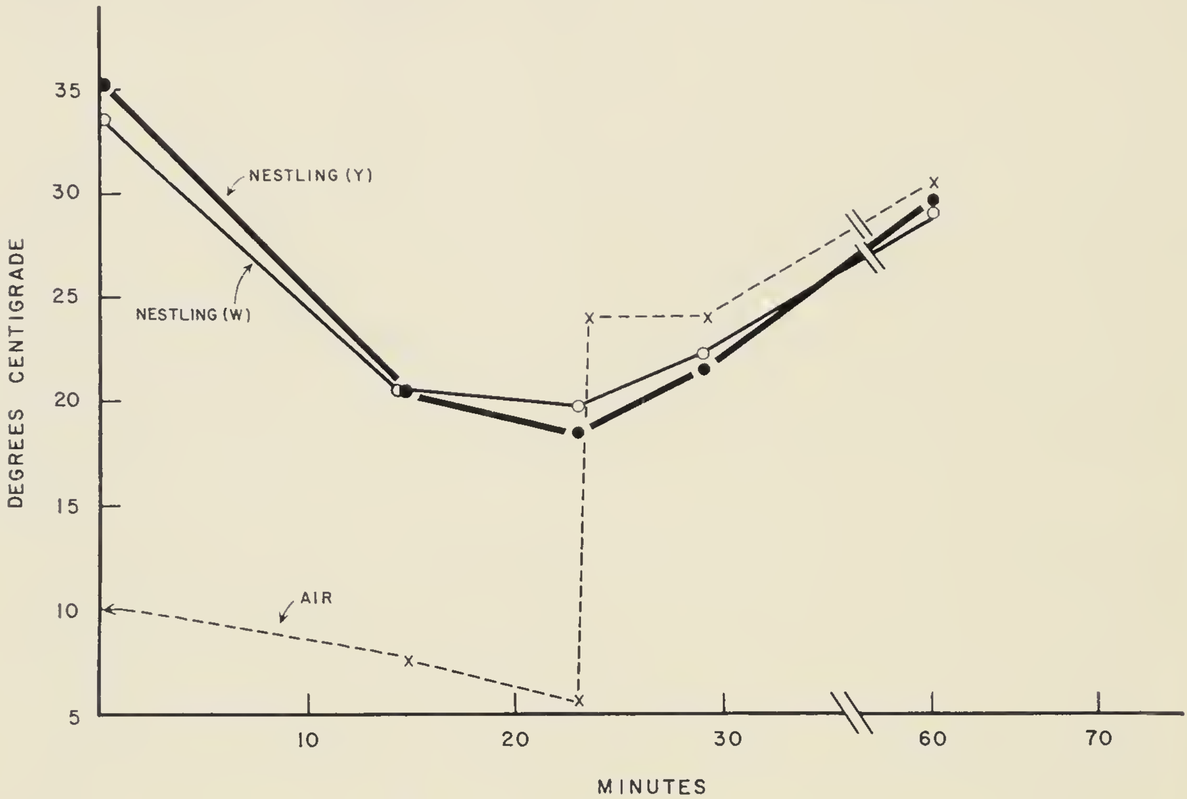

FIG. 1. Responses of Least Terns of approximate ages of one (W) and two (Y) days to low and moderate ambient temperatures.

The bird was visibly affected by the high ambient temperature after five minutes of exposure, for it began to call, hop about, and pant. From this time on the bird seemed to be in a state of increasing distress. Its beak was kept open and its whole body trembled with the effort of violent panting. The respiratory rate was too rapid for an accurate count, and there seemed to be an erythemia of the linings of the mouth and pharynx. The bird was removed from the 45°C. test chamber after 38 minutes and was exposed to ambient temperatures of 23 to 27°C. for the next 35 minutes, during which time it was being returned to its nest. When replaced in the nest at 5:10 p.m., the bird's body temperature had dropped to 35°C.; a parent bird came and settled down to brood the young one as soon as I walked away.

These data indicate that very young nestling Least Terns show considerable lability of body temperature (a range of at least 24°C.) but that they are capable of regulating effectively for at least 38 minutes under severe heat stress.

Comparative information was obtained on a juvenile Least Tern of an estimated age of two weeks. This bird was fully fledged and able to fly, but after two flights of about 40 and 15 yards, respectively, it appeared to be exhausted and was captured by hand. Its body temperature at the time of capture was 39.2°C., and it weighed 37.6 grams. The bird was placed in a closed chamber at an ambient temperature of 20°C. and subsequently at 10°C.; its body temperature at the start of the experiment was 37.6°C. Results are shown in Figure 3.

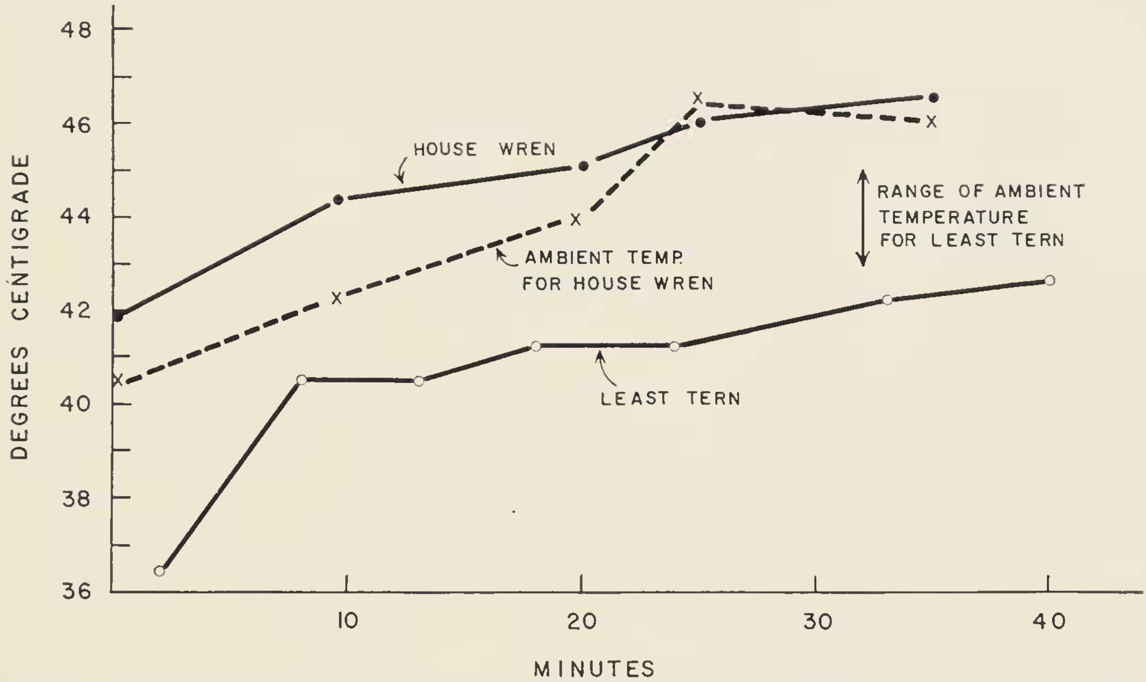

FIG. 2. Response of Least Tern of approximate age of two days to continuous ambient temperatures of 43 to 45°C. Data on House Wren nestling of similar weight is replotted from Baldwin and Kendeigh (1932:118).

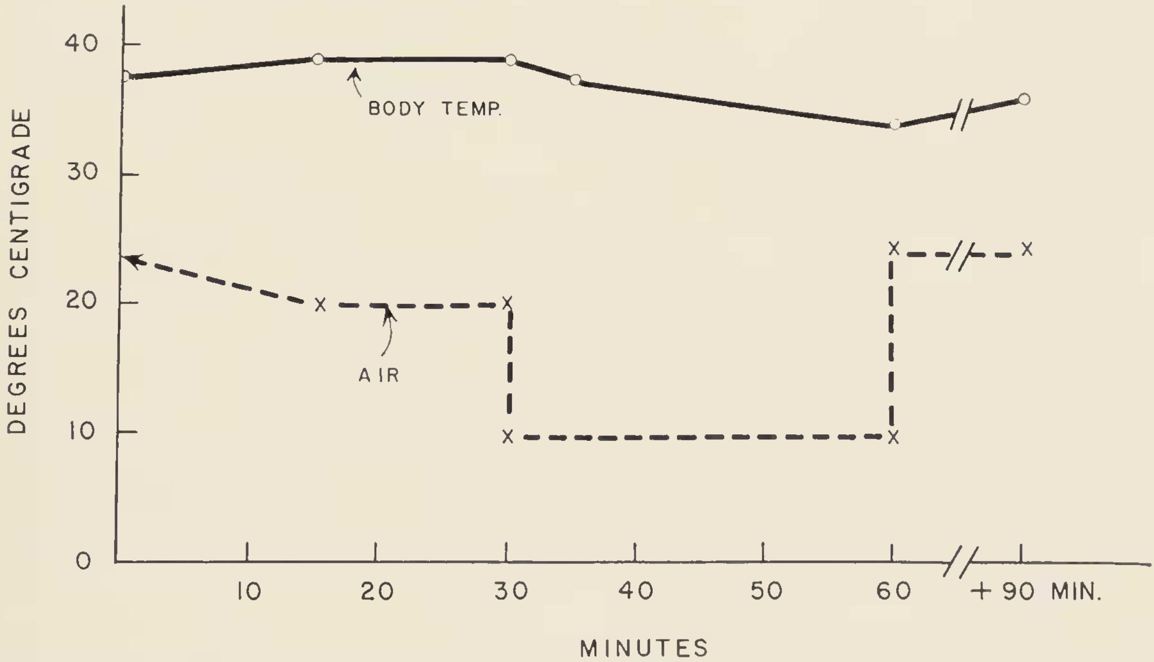

FIG. 3. Response of Least Tern of approximate age of two weeks to varying ambient temperature.

Although this juvenile regulated well at moderately cool ambient temperatures, it showed a drop in body temperature below the usual adult level when subjected to somewhat greater cold stress. The young tern was captured about two hours before the experiment began, and as I did not feed it the bird was without food for at least two hours and perhaps much longer. It may have been running out of energy reserves by the time it was subjected to the ambient temperature of 10°C., and its slow recovery to higher body temperatures supports this suggestion. However, it flew from my hand when I returned it to the nesting colony, and it was last seen running rapidly for cover.

Nighthawk

This species lays its two eggs on the bare sand at Grand Isle, but the nest site is usually among small tufts of vegetation where the concealing coloration of the adults and young is most effective. The vegetation provides small patches of shade, but not enough to shield the parent bird or to cover the sand between adjacent clumps of grass, especially during the middle of the day when solar heat is most intense. July is late in the breeding season of nighthawks in southern Louisiana, and I was not able to find any newly hatched nestlings. The youngest birds I could find were two of an estimated age of five and six days—the estimate based on camparison with photographs of nestlings of known age given in Bent (1940). These young birds were kept under observation for seven days, and additional data were obtained from two others of ages estimated at 15 to 16 days and from a juvenile nighthawk about 24 days old.

As with the Least Terns, I attempted to take temperatures of the young as soon after the departure of the brooding parent as possible and then at regular intervals while the young were unbrooded. In my limited study, I found that the young up to at least 15 days of age were brooded during the entire day. I did not find them brooded during the early part of the night, but no observations were made later than about three hours after sunset.

The brooding parent left the young only when closely approached, and the bird invariably departed with an "injury-feigning" type of flight, as described by Tomkins (1942). The adult nighthawk flopped away with extremely labored wingbeats and with the tail hanging vertically; often the bird collapsed a few yards away with wings and tail spread and mouth gaping. This behavior was a good indication that the parent had just left its young and was quite useful to me in locating them. As I was primarily concerned with getting temperatures of the young immediately, I did not attempt to identify the sex of the brooding parent each time. However, when such identification was made the bird was a female.

The body temperatures of young of different ages under various conditions of exposure are given in Tables 2–4.

Table 2

Environmental Temperatures and Body Temperatures (in °C.) of Two Young Common Nighthawks

	5 to 6 Days Old					6 to 7 Days Old			
	(Consecutive Observations)			(Consecutive Observations)		(Consecutive Observations)			
Time since parent left	2 min.	+ 15 min.	Time lapse	1 min.	+ 15 min.	1 min.	+ 7 min.	Time lapse	> 3 min.
Ground	40.0	40.0		31.5	31.5	41.0	41.0		
Black-bulb				30.0	30.0	41.5	41.5		30.6
Air	33–34	33–34		29.5	29.5	35.5	35.5		29.5
Bird No. 1	39.5	42.0		38.5	36.5	39.8	44.0		38.0
Bird No. 2	38.5	41.0		38.5	37.0	40.5	43.0		38.0

Table 3

Environmental Temperatures and Body Temperatures (in °C.) of Two Young Common Nighthawks

	7 to 8 Days Old						
	(Consecutive Observations)			(Consecutive Observations)			
Time since parent left	1 min.	+ 6 min.	Time lapse	1 min.	+ 15 min.	+ 15 min.	+ 15 min.
Ground	42–43	42–43		31.5			
Black-bulb	38.2	38.2		29.0	29.0	28.5	28.5
Air							27.2
Bird No. 1	40.5	43.0		38.5	37.0	36.4	34.8
Bird No. 2	40.5	43.5		38.2	36.8	37.0	36.8 (active)

Table 4

Environmental Temperatures and Body Temperatures (in °C.) of Two Young Common Nighthawks

	10 to 11 Days Old		11 to 12 Days Old			15 to 16 Days Old
	(Consecutive Observations)		(Consecutive Observations)			
Time since parent left	1 min.	+ 15 min.	1 min.	+ 15 min.	+ 6 min.	> 5 min.
Black-bulb	37.5	34.0	39.0	39.0		
Air	31.0	31.5	32.0	32.0		28.0 (night)
Bird No. 1	39.4	42.0	39.5	42.5		37.8
Bird No. 2	39.0	41.5	39.5	41.5	41.8	38.2

Although the youngest nighthawks were five to six days old, their body temperature at this and more advanced ages was more labile than that of the younger Least Terns under natural conditions. The nestlings of these two species would not normally be exposed to very cold conditions, but the difference in their response to heat is noteworthy. After only seven minutes exposure to hot, direct sun (black-bulb temperature 41.5°C.), nestling nighthawks six and seven days old experienced a rise in body temperature to 43 and 44°C. Even after 38 minutes exposure to an ambient temperature of 43 to 45°C., a two-day-old Least Tern did not reach this level of body temperature. The young nighthawks showed great distress at the elevated body temperatures, and I have little doubt that they would have died if left exposed for 15 or 20 minutes longer. A body temperature of about 46°C. is lethal for the House Wren (*Troglodytes aedon*) (Baldwin and Kendeigh, 1932), and as I did not want to risk having the young nighthawks reach this level and perish I left after the seven-minute interval. A parent bird immediately returned and brooded the young, and they evidently suffered no lasting ill effects. On the following day similar results were obtained, but equally hot environmental conditions did not occur at later stages in the growth of the young and the highest body temperatures subsequently recorded were not over 42.5°C. The lowest body temperature recorded was 34.8°C., after 45 minutes exposure of an eight-day-old bird to an ambient temperature of 27 to 28°C. Gular flutter in response to heat stress was noted in nighthawks of all ages.

The behavior of the nestlings is important with regard to temperature regulation. The five- and six-day-old nestlings were able to run about, although not very rapidly. When the parent was flushed and the young were closely approached, the latter usually ran off for a short distance and then stopped. This running appeared to be essentially undirected, and a nestling was just as likely to come to rest in an open, unshaded spot as in a more concealing and shaded location. If disturbed again or if apparently uncomfortable from exposure, the birds again moved off but often to an equally "unsatisfactory" exposed location. By the time the young were about 11 and 12 days old, however, their movements were much better directed. I was unable to keep them exposed to sun for more than 15 minutes, for after this time they went more or less directly to a nearby patch of shade and remained there unless chased out.

These observations indicate that nestlings under about 12 days of age would not be likely to survive unless closely brooded by a parent. Their body temperature regulation is probably not adequate to cope with exposure to normal extremes of heat for more than a few minutes, and they are unable to reach shelter except by chance. By about 12 days of age their temperature regulation is still imperfect, but the birds are able to seek shade when exposed to intense solar heat. After an age of about 15 days is reached the young may not be continuously brooded; their body temperature regulation has presumably improved although data on this point are not available. However, I was able to obtain the following information on a bird of slightly more advanced age.

A juvenile nighthawk of an estimated age of 24 days was captured on July 23; it was evidently exhausted after two flights of about 50 yards each and was caught by hand after the second one. This bird was then exposed (with intervening rest periods) to cold stress in a refrigerator and to heat stress by tethering it in full sun. It was then confined in the dark at about 30°C. for 24 hours, making a total of at least 29 hours without food. The results are given in Table 5, and except for a slight drop in body temperature when first subjected to cold and a slight rise after exposure to heat, the various experimental conditions seemingly had little effect; only the drop to 37.5°C. might be considered outside the usual limits of fluctuation. The bird was given food and water at the end of the darkness-starvation period and released in apparently good condition. It seems likely that body temperature regulation in young birds over three weeks old is essentially as effective as that of adults.

Table 5

Environmental Temperatures and Body Temperature (in °C.) of a Young Common Nighthawk, Estimated Age 24 Days

Conditions:	Exhausted after two flights	20 min. rest	15 min. in refriger-ator	30 min. rest; 30 min. in refrigerotor	30 min. rest; full sun 16 min.	+ 15 min.	+ 13 min.	+ 14 min.	+ 24 hrs. without food
Black-bulb					39.0	39.0		29.0	
Air	28.5	28.6	12.0	12.0	31.0	31.0		27.2	30.5
Body	38.8	39.0	37.5	39.4	41.4	41.5	41.0	40.0	39.5

One other point of possible interest with regard to survival of young nighthawks may be mentioned here. The nesting areas of this species at Grand Isle are inhabited by swarms of the salt marsh mosquito (*Aedes solicitans*), and the hordes of these voracious insects sometimes made prolonged data-gathering by a human observer an impossibility. However, although the youngest nighthawk nestlings had conspicuous areas of bare skin showing along the apteria, I never saw a mosquito alight on a young bird or even hover around one. Probably the nestlings could not survive such locations if they were subject to attack by the more common species of mosquitoes.

Discussion

Body temperatures of nestling gulls (*Larus* sp.) under various environmental conditions have been studied by Barth (1951), Bartholomew and Dawson (1952. 1954), and Behle and Goates (1957). Abdulali (1940) reported mortality of nestling Least Terns (*S. a. albifrons*) after 15 to 20 minutes of exposure to hot sun, but this observation was incidental to a photographic study and neither ambient nor body temperatures were recorded. I know of no published records of body temperatures of young Least Terns of either Old or New World populations.

The observations of Barth (1951) on young *Larus canus* are closely comparable to those reported here. Barth found body temperatures to range from 16°C. to 44.2°C., depending on age and environmental conditions. After 34 minutes of exposure to ambient temperatures from 41 to 43°C., a four-day-old bird reached a body temperature of 45.3°C. and died. The next highest body temperature reading, 44.2°C., was reached by an 8½-day-old bird after 10 minutes of exposure to an ambient temperature of 47°C.; the body temperature was not lethal in this instance. Barth concludes that the young gulls are better able to *tolerate* low ambient temperatures than high ones but that the capacity for *regulation* is better under the latter conditions. The results reported here on the Least Tern are generally in accord. However, the Least Tern breeds primarily in warm climates where ambient temperatures as low as those occurring in some high latitude gull colonies do not occur. It appears that very young Least Terns regulate at least as well at high ambient temperatures as somewhat older nestling gulls. As ambient temperatures high enough to constitute a threat to the survival of young Least Terns may be expected to occur during their breeding season, it is not surprising that this species apparently has evolved more effective regulation of body temperature under heat stress. It may be noted that the small size of the Least Terns as compared with gulls means a relatively larger body surface, and this makes even greater the problem of heat loss when the air and/or substrate temperatures are higher than the body temperature.

Bartholomew and Dawson (1952) recorded temperatures of young Western Gulls (*Larus occidentalis*) of ages varying from those in pipped eggs to at least two weeks old. Even in pipping young that were unbrooded for 45 minutes, the body temperatures were no less than 32.3°C. at an air temperature of 27°C. In contrast, a hatchling Least Tern did not regulate as well as this at ambient temperatures that were slightly higher (Table 6). In this instance the relatively greater body surface of the small tern would tend to increase heat loss to a cooler environmental temperature.

Behle and Goates (1957) studied young California Gulls (*Larus californicus*) from the pipped egg stage up to about 21 days of age. The ambient temperatures and the duration of time unbrooded differed from those to which the Least Terns were subjected, and the data cannot be closely compared. Incompletely hatched California Gulls at air temperatures from 29 to 33°C. had body temperatures between 36 and 37°C.; this seems to indicate better capacity for regulation than in the Least Tern (Table 6) at a slightly later and drier stage, but the time unbrooded was not known for the young gulls and the comparison is thus of doubtful value.

TABLE 6

ENVIRONMENTAL TEMPERATURES AND BODY TEMPERATURE (IN °C.) IN A NEWLY HATCHED LEAST TERN

	(Consecutive Observations)			(Consecutive Observations)		
Age	4 hrs.	+ 15 min.	Time lapse	17 hrs.	+ 15 min.	+ 15 min.
Ground	34.8	34.8		26.6	26.6	26.6
Black-bulb	34.0	35.8		30.5	29.5	29.5
Air		31.6		27.8	28.6	28.5
Body	39.5	36.0		35.8	31.0	30.2

Rolnik (1947) studied the effects of cold on the young of several species of gulls and other birds nesting on arctic islands in the Barents Sea. He found that a one-day-old Kittiwake (*Rissa tridactyla*) weighing 38.5 grams went from a body temperature of 36°C. to 19.8°C. after 75 minutes at an air temperature of 6.5°C. In contrast, the 5.7 gram Least Terns studied by me took only 23 minutes to reach body temperatures of 18.5 and 19.8°C. under very similar conditions (Fig. 1). Here again, the small size of the tern nestlings is undoubtedly important in accounting for this difference in rate of cooling.

Rolnik also described a state of "apparent death" in nestlings at body temperatures of 9 to 15°C. from which the birds fully recovered when warmed. His interesting experiments deserve to be repeated, especially with temperate and tropical charadriiform species.

Data on body temperature regulation of altricial birds of a size comparable to young Least Terns are given by Baldwin and Kendeigh (1932) and by Dawson and Evans (1957). Baldwin and Kendeigh give weights of young House Wrens at four days and at 11 days as 4.6 and 10.4 grams, respectively; presumably young wrens at age five to seven days would weigh about five or six grams and thus approximate the weight of the young terns. Baldwin and Kendeigh (1932:118) show the response of a seven-day-old wren to high air temperature. These data are replotted on Figure 2, illustrating the relatively poor regulatory capacity of the young wren as compared to that of a young tern of similar size.

Dawson and Evans (1957) give figures on body temperatures of young Field Sparrows (*Spizella pusilla*) and Chipping Sparrows (*S. passerina*) at air temperatures of 10 to 40°C. Three-day-old sparrows of these species are comparable in weight (mean weights 5.9 and 5.5 grams, respectively) to the youngest Least Terns. The body temperature of the sparrows at age three days appears to vary almost directly with the air temperature but remains slightly above it, especially at the higher end of the scale where the difference is on the order of 5°C. The nestling terns showed much greater capacity for temperature regulation than this.

In summary, it appears that young Least Terns regulate their body temperature as well or better than young gulls of similar age in response to high ambient temperatures, somewhat less effectively than gulls in response to low ambient temperatures, and, of course, much better than altricial nestlings of similar age and size at either high or low ambient temperatures. However, if one compares age from beginning of incubation in the terns and in the altricial sparrows, it is evident that the latter achieve essentially complete homeothermy in a shorter period of time. The incubation period of the Least Tern is about 21 days whereas that of the Field and Chipping Sparrows is 11 to 12 days. The sparrows achieved homeothermy at 7 to 10 days after hatching or about the 18th to 21st day after the start of incubation (Dawson and Evans, 1957); the newly-hatched Least Tern, at a "total age" of 21 days, is quite imperfectly homeothermic.

It is equally evident that young nighthawks are not precocial in a strict sense although they exhibit some characteristics of that condition. They are covered with down on hatching and are active at an early stage; indeed, they are nidifugous although not fully homeothermic. This raises the question of whether the order Caprimulgiformes can be called either precocial or altricial, whether some members of the order are definitely one or the other, or whether an intermediate condition prevails throughout the group. There is no unanimity in the literature on this order. The Heinroths (1924–33) regard the ground-nesting species as semiprecocial and the tree-nesting types (such as *Nyctibius*) as altricial. Witherby *et al.* (1938) consider the "young helpless"; A. O. Gross (Bent, 1940:221) says of the Common Nighthawk that "on the first day the young are able to stand upright and are very active at the time of hatching." Weller (1958) supports this observation, and Pickwell and Smith (1938) describe hatchling Lesser Nighthawks (*Chordeiles acutipennis*) as fully able to move about. Similar comments are found in Bent (1940) with regard to the young of other North American caprimulgids such as *Caprimulgus carolinensis* (p. 151), *C. vociferus* (p. 169), and *Nyctidromus albicollis* (p. 201). Aldrich (1935) found nestling Poor-wills (*Phalaenoptilus nuttallii*) to be active, but Brauner (1952) reported that in three-day-old Poor-wills the body temperature went as low as 20.3°C. at an ambient temperature of 12.6°C. after a little over two hours unbrooded. In view of the great lability of body temperature under certain conditions in the Poor-will and in the Lesser Nighthawk (Marshall, 1955), it is likely that extensive further investigation of temperature regulation in both nestlings and adults of any caprimulgiform species would be worthwhile. The almost complete absence of temperature data on nestlings makes any generalization tenuous, but it appears that the young of some caprimulgiforms look and act like precocial nestlings but lack the degree of homeothermy associated with that condition.

Summary

Young Least Terns (*Sterna albifrons*) and Common Nighthawks (*Chordeiles minor*) were subjected to heat and cold stress under field and laboratory conditions and their responses in terms of body temperature were recorded. Very young Least Terns are imperfectly homeothermic; they regulate body temperature less well at low air temperature but better at high air temperature than gulls of similar age, and their capacity for temperature regulation is much better than that of altricial nestlings of similar size. Young Common Nighthawks are even more imperfectly homeothermic, and they appear to be intermediate between the precocial and altricial conditions.

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